Public Review Comment Metric

Originating Office:	Document Description: TSO-C145e	Project Lead/Reviewer	Reviewing Office:	Date of Review:
AIR-130		Kevin Bridges		

	Commenter	Section # and Page #	Comment	Suggested Change and Rationale	Disposition
1.	Airbus	§3.a page 2	*"PRN range of 120 thru 156"* ⇨ The last authorized PRN is 158.	Suggested to change to "PRN range of 120 thru 158" as stated in DO-229E Appendix A §A.3.4	**Accepted.**
2.	Airbus	§3.h page 4	Reference to AC20-115 (latest revision) is more stringent that what is stated in DO-229E that refers to AC20-115C or a later revision.	Suggested to change to "AC 20-115C (or later revision)"	**Accepted.**
3.	Airbus	Appendix 2 page 2-2	*" it is recommended that manufacturers reference their equipment aircraft information security review and mitigation strategies in the equipment's installation manual so that the applicant can consider them in meeting the installation regulatory requirements."* ⇨ TSO should not ask to refer the mitigation strategies in a document that can be easily accessible	Suggested to change as follow: *" … it is recommended that manufacturers* ***inform applicants*** *about their equipment aircraft information security review and mitigation strategies so that the applicants can consider them,* ***if necessary,*** *in meeting the installation regulatory requirements."*	**Accepted.**
4.	CMC	Section 3.a Page 2	SBAS PRN range is wrong.	SBAS PRN range is 120 thru 158 instead of 120 thru 156.	**Accepted.**
5.	CMC	Section 3.g Note 1 Page 3	Reference to paragraph 3.g is wrong.	Replace 3.g with 3.k.	**Accepted.**

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6.	CMC	Section 3.h.(1) Page 4	Reference to paragraph 3.b is wrong.	Replace 3.b with 3.e.	**Accepted.**
7.	CMC	Section 3.i.(1) Page 4	Reference to paragraph 3.b is wrong.	Replace 3.b with 3.e.	**Accepted.**
8.	CMC	Section 4.a Page 5	Missing "." at the end of the sentence. Unclear if just "." missing or if second sentence of TSO-C145d accidentally deleted.	Add ".". May also need to add "The marking must include the serial number.".	**Accepted.** Included the period at the end of the sentence. The template in Order 8150.1D no longer contains the sentence about marking with the serial number because the statement conflicts with 14 CFR 45.15(b).
9.	CMC	Section 5.m Page 8	Reference to paragraph 3.c is wrong.	Replace 3.c with 3.f.	**Accepted.**
10.	CMC	Section 6.f Page 8	Reference to paragraph 3.d is wrong.	Replace 3.d with 3.g.	**Accepted.**
11.	CMC	Section 6.g Page 8	Reference to paragraph 3.e is wrong.	Replace 3.e with 3.h.	**Accepted.**
12.	CMC	Appendix 1 Section 4 (a) Page 1-4	Incomplete section name "Acquisition Time", "Reacquisition Time".	Use full section name "Initial Acquisition Time", "Satellite Reacquisition Time"	**Accepted.**
13.	CMC	Appendix 1 Section 4 (a) Page 1-4	Reference to 2.3.6.2 is wrong since Class Delta-4 is covered by TSO-C146.	Delete reference to 2.3.6.2.	**Accepted.**
14.	CMC	Appendix 1 Section 4 (d)	Reference to paragraph 3.d is wrong.	Replace 3.d with 3.g.	**Accepted.**

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		Page 1-4			
15.	CMC	Appendix 1 Section 4 (d) Page 1-4	"Sections 16.5.1.2 and 16.6.1.2 are for Normal/Abnormal Operating Conditions." is wrong; both sections are for noise under normal operation.	Sections 16.5.1.2 and 16.6.1.2 are for supply voltage modulation (ac) / ripple (dc).	**Accepted.**
16.	CMC	Appendix 1 Section 6 (b) Page 1-6	Reference to paragraph 3.d is wrong.	Replace 3.d with 3.g.	**Accepted.**
17.	CMC	Section 3 and appendix	In RTCA/DO-229E environmental test requirement tables, the X for Acquisition versus Reacquisition is supposed to be based on Abnormal versus Normal power input not DC versus AC power input.	TSO should put an amendment to correct this issue: Initial Acquisition Time requirement should apply to both AC and DC equipment under abnormal operating condition (DO-160E section 16.5.2 and 16.6.2) and Satellite Reacquisition Time requirement should apply to both AC and DC equipment under normal operating condition (DO-160E section 16.5.1 and 16.6.1).	**Accepted.**

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18.	Embraer	Section 1.8.3 and page 2-1.	Include a reference to DO326A/ED-202A about system information security.	DO-326A/ED-202A provides guidance to assess vulnerabilities and identification of required mitigation.	**Accepted.**
19.	Garmin	3.e.(4) Page 3	Paragraph. 3.e.(4) includes the statement: Design the system to at least these failure condition classifications consistent with the operational capability. Wording needs to change to allow failure condition to be determined at the aircraft level. This statement implies the failure condition classification of an appliance is determined by the TSO regardless of mitigations employed to meet aircraft level safety requirements such as redundant appliances/systems. Unless the DAL cannot be affected by the installation, the aircraft System Safety Assessment should determine the failure classification and by extension, the design assurance level (DAL) requirement. The aircraft FHA/SSA	Suggest changing to the alternate wording identified in paragraph 3.b. of the TSO Template in Order 8150.1D Appendix G.	**Not Accepted.** The TSO provides a design approval for the equipment based upon the intended function. For TSO-C145, the intended function has an identified failure condition classification. The DAL a manufacturer chooses to meet that failure condition is based upon the target aircraft installation (i.e., 14 CFR Part 23, 25, 27, 29). Manufacturers can request a deviation to use a different DAL for a particular target aircraft if there is an equivalent level of safety provided thru a limitation on installation guidance to mitigate the issue.

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			ultimately determines the DAL requirement for a particular installation. Specifying the DAL at the appliance level without the benefit of the specific aircraft level FHA/SSA means that in some cases the DAL will undoubtedly be higher and more costly than necessary. This will have a chilling effect on the installation of new, safety enhancing technologies since the cost will be greater than necessary. It is possible to build and certify a TSOA appliance that cannot be approved for installation in one or more aircraft types because it does not have the required DAL. Similarly, just because the appliance meets a TSO DAL does not mean it can be approved for installation. We recommend that no failure classification/DAL requirement be included in a TSO when the installation can affect or mitigate the hazard level and therefore consideration should be given to revising paragraph 3.c in this TSO to the general guidance in the Recommendation column.		

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20.	Garmin	3.i Page 4	Including this specific DO-254 reference is redundant to the rest of the paragraph in this section. For custom airborne electronic hardware determined to be simple, RTCA/DO-254, paragraph 1.6 applies. DO-254 makes it clear how to address "simple" custom airborne electronic hardware.	Remove this reference to DO-254 Paragraph 1.6.	**Not Accepted.** This is specific language required by the Order 8150.1D template and is not actually redundant. If the sentence is omitted, only complex custom AEH would be referenced. See the sentence just prior to that. If reference was to AC 20-152 instead of DO-254, both simple and complex would be addressed. Although Order 8150.1D does reference AC 20-152, it only does so wrt deviations and data submittal. The intent for the reference is ensuring TSO applicants understand their responsibilities per DO-254 even with "simple" hardware. . However, this comment will be forwarded to the POC for Order 8150.1D to consider changes in future revisions.

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21.	Garmin	4.b.(2) Page 5	Paragraph 4.b.(2) states: Each subassembly of the article that you determined may be interchangeable. This language is confusing.	The language for this requirement is confusing. This could mean that a stuffed printed circuit board needs the TSO number. Suggest removing the statement or updating to wording identified in paragraph 4. of the TSO Template in Order 8150.1D Appendix G.	**Not Accepted.** There are two different TSO templates; one for avionics and one for non-avionics that are substantially similar but have some differences. TSO-C145e uses the avionics template which contains the specific language used. This language should not be objectionable since it gives discretion to the manufacturer to determine which subassembly is interchangeable and thus requires marking.
22.	Garmin	5.i Page 7	Paragraph. 5.i includes the statement: Identify functionality or performance contained in the article not evaluated under paragraph **3** of this TSO (that is, non-TSO functions). The GAMA 16-28 "Industry Recommendations on the Management of Non-Technical Standard Order Functions" Recommendation 2	1) Remove "or performance" in accordance with the GAMA non-TSO function recommendations. 2) Update Order 8150.1D Appendix G paragraph 5.f in accordance with the GAMA recommendations. 3) Work with GAMA to	**Partially Accepted.** TSO-C145e follows the current TSO template language. However, this recommendation will be forwarded to the POC for consideration in the next update.

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			recommended revising the Appendix G TSO template to remove "or performance" from the quoted paragraph 5.i statement to ensure non-TSO function definitions are "fully aligned with the original intended N8150.3 definition". This recommendation was not followed when FAA Order 8150.1D was published.	address all the non-TSO function recommendations.	
23.	Garmin	5.i.(7) Page 7	Paragraph 5.i.(7) includes the statement: Alternatively, identify non-TSO functionality or performance contained in the article not evaluated under paragraph **3** and submit previously accepted data for the non-TSO function for acceptance in parallel with this TSO application. This paragraph is not included in the FAA Order 8150.1D Appendix G TSO template. It is unclear whether this statement is intended to respond to one or more of the GAMA 16-28 "Industry Recommendations on the Management of Non-Technical Standard Order Functions". Regardless, the statement has the same issue as identified with	Remove "or performance" in accordance with the GAMA non-TSO function recommendations.	**Partially Accepted.** This recommendation will be forwarded to the POC for consideration in the next update.

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			paragraph 5.i regarding use of the phrase "or performance".		
24.	THALES Avionics	Appendix 2	To address information security, the document should refer to the RTCA/EUROCAE documents on information security such as (DO-326A / ED-202A, DO-355 / ED-204, upcoming DO-356A / ED-203A). While the document, of course, may reference some active security measures as recommendations, the document should clearly promote the use of Standards.	These references should be listed in the (last) paragraph 1.8.3 of Appendix 2: Instead of "Therefore, it is recommended … meeting the installation regulatory requirements." Replace by "Therefore, it is recommended that manufacturers document their Security Assurance Level objectives to protect the main functions of equipment with a low direct impact and avoid propagating an attack to other equipment. In this purpose, supplemental guidance material may be found in RTCA/EUROCAE such as DO-326A / ED-202A, DO-355 / ED-204, DO-356A / ED-203A.	**Partially Accepted.** Draft documents cannot be referenced in the TSO, so references to DO-356A/ED-203A cannot be included. References to DO-326A/ED-202A and DO-355/ED-204 are now included at the end of the second paragraph. However, section 1.8.3 is informational in nature and not a requirement. Manufacturers may use any reference material they choose to address cybersecurity issues.
25.	THALES Avionics	Appendix 2	It is proposed to explicitly mention that security defences and measures should be	Adding the following sentence :	**Partially Accepted.** The following sentence was

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			ensured by the aircraft operator all along the lifetime of the equipment use.	"Appropriate procedures for aircraft operators should be established by Aircraft manufacturer to ensure that the approved security protection of the equipment is maintained all along the lifetime of the equipment installation in the aircraft".	added to the last paragraph as the next to last sentence: "*Additionally, aircraft manufacturers should consider establishing appropriate procedures for aircraft operators to maintain security protection of the equipment during the life of the equipment installation in the aircraft.*"
26.	THALES Avionics	Appendix 2	It is understood that equipment manufacturers should provide security information in the Installation Manual so that the aircraft manufacturer can consider them in their vulnerability risk assessment. Nevertheless, too much documenting the mitigation strategies may impair safety, by highlighting equipment vulnerabilities.		**Noted.** Section 1.8.3 is informational only and there are no instructions to document anything in the Installation Manual.
27.	THALES Avionics	3.g	It is proposed to add possibility to use RTCA/DO-160F or RTCA/DO-160G without going through a deviation process. Those newest versions of DO-160 are providing an equivalent level of safety.	Adding the following sentence: "RTCA/DO-160F or RTCA/DO-160G can be used as applicable environmental standards instead of	**Not Accepted.** This issue was discussed at SC-159/ WG-2 during the DO-229E process and the decision was to remain with DO-160E for a legacy upgrade path

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				RTCA/DO-160E. It is not permissible to mix versions within a given qualification program.	without a new environmental qualification. However, the last sentence in the TSO paragraph states: "*You may use a different standard environmental condition and test procedure than RTCA/DO-160E, provided the standard is appropriate for the SBAS sensor*." This provides manufacturers the ability to use later DO-160 versions without having to request a deviation. This sentence was specifically included to allow manufacturers to use other DO-160 revisions (except as discussed in note 1) without the need for a deviation.